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A. Survey of possible military applications of laser technology

For the purpose of this survey possible military applications can be divided into three categories.

1. Applications which, by themselves, are not weapons, some of which are already in an advanced stage of development or, in some cases, operational.

First of all, there are applications which have no typical military character but may prove to be equally important for civil and for military purposes. One such application is the use of laser beams for communication purposes. Lasers offer far-reaching possibilities for communications. It is theoretically possible that a great number of messages can be transmitted simultaneously by means of one single laser beam. Another example of laser technology is the construction of optical computers. Both laser communication systems and laser optical computers could be suited for military uses.

Another form of laser technology, which is more directly relevant to warfare, is the laser range-finder. Here lasers can be used instead of radar for measuring distances.

Other military applications comprise the use of laser beams for surveillance and reconnaissance purposes. For instance in the line-scanning camera, and the development of laser devices for navigation systems for missiles and aircraft and possibly, in the future, for submarines and for detection of submarines.

Next we come to applications of lasers which, though not constituting a weapon as such, are very closely connected with the use of weapons, as a valuable aid to increase their effectiveness. This is the laser illuminator or designator; a laser beam is used to designate a target to be attacked by bombs, rockets, missiles or artillery. The designator can be operated by a forward air controller on the ground or from an aircraft. At the same time, a seeking device must be used in the attacking weapon in order to enable it to lock on the designated target and to home in on it. It appears

that this method of laser designation and guidance for air bombardment has already been tested and used in prototype form and proven to increase attack accuracy. Significant increases in accuracy would provide economies in the operation of weapon systems. This development of laser technology, therefore, offers both military and financial advantages.

2. Direct use of lasers as weapons. In this instance the heat of a laser beam is used to destroy a target. It is now already possible to pierce and to cut objects by means of laser beams at a distance of several yards. For use as weapons it would be necessary to achieve such effects at much larger distances. A number of difficult technological problems are yet to be solved.

Among the future largely tactical applications for which laser weapons appear to be conceivable are:

-- defence of naval vessels against low-flying cruise missiles;
-- defence against low-flying targets at forward air bases;
-- defence against tanks on the battlefield;
-- defence against optically guided weapons like optical or infrared missiles, and countermeasures against a host of night vision, infrared and photograph surveillance devices.

An even more remote possibility might be the use of laser weapons for ballistic missile defence. The laser could offer some potential advantages over present A.B.M. systems. Because laser beams travel at the speed of light, the defence could have more time to detect, track, and intercept incoming missiles. Further, a laser A.B.M. weapon would not, itself, produce fall-out. On the other hand, the practical difficulties in developing this type of weapon are likely to be much greater than those of the close-range weapons discussed above. Generating and directing the large amounts of energy, aiming the laser beam, and transmitting it to the target are very difficult technical problems. Further, such a weapon system depends upon the transmission of optical energy and would, therefore, be severely limited for use on cloudy days or in the presence of precipitation.

It has also been speculated that lasers might conceivably be used as weapons of mass destruction in outer space. In addition to certain of the limitations described above, there are inherent characteristics of the laser, notably its narrow beam width and its short effective range, which would militate against its use as a

weapon of mass destruction. In the unlikely event that such a weapon were developed, it should be noted that the Outer Space Treaty already prohibits stationing weapons of mass destruction in outer space.

3. Lastly, a third category of potential military laser technology has recently been referred to in the press. This is the possible use of lasers, instead of fissionable materials, to set off thermonuclear weapons. For that purpose, a laser device which could produce an incredibly high temperature during an incredibly short time would be required. Moreover, such a device would have to be of such moderate dimensions that it could be included in a warhead or bomb. Again, a number of extremely difficult problems would appear to require solution before this type of weapon could be developed. In any event, were such a weapon to be developed, articles I and II of the N.P.T. would continue to apply to the thermonuclear weapons involved.

B. Arms control problems in connexion with the military application of laser technology

With respect to the first category, i.e. applications of laser technology for non-weapon military purposes, it would not seem fruitful to consider the possibility of restrictive measures. It is true that such applications as the laser designator can have an important impact on the conduct of military operations, but it is unlikely that agreement could be reached on a ban or restrictions on devices that are not weapons.

As to the second category, i.e. laser weapons, it would perhaps seem rather premature to consider the possibility of any arms control ban. This is because it is not clear at this stage, whether independent laser weapons systems are a practical and significant possibility.

With respect to the third category, the laser device for exploding a thermonulcear weapon, it has already been pointed out that a number of extremely difficult problems would appear to require solution before this type of weapon could be developed and that articles I and II of the N.P.T. would be applicable to such weapons if developed.

Accordingly, the highly speculative character of the conceivable military applications mentioned in the preceding paragraphs does not seem to substantiate the need for arms control consideration at this time. On the other hand, it seems appropriate to follow attentively further developments in the field of military applications of laser technology with a view to possible future arms control discussion.